CHOICE-MAKING TREATMENT OF YOUNG CHILDREN'S SEVERE BEHAVIOR PROBLEMS

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The choice-making behavior of 5 young children with developmental disabilities who engaged in aberrant behavior was studied within a concurrent operants framework. Experimental analyses were conducted to identify reinforcers that maintained aberrant behavior, and functional communication training packages were implemented to teach the participants to gain reinforcement using mands. Next, a choice-making analysis, in which the participants chose one of two responses (either a mand or an alternative neutral response) to obtain different durations and qualities of reinforcement, was conducted. Finally, treatment packages involving choice making via manding were implemented to decrease inappropriate behavior and to increase mands. The results extended previous applications of choice making to severe behavior disorders and across behaviors maintained by positive and negative reinforcement.

DESCRIPTORS: aberrant behavior, choice making, functional communication training, functional analysis, developmentally disabled children, behavioral pediatrics

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Mace and Roberts (1993) suggested viewing adaptive and aberrant social behaviors as concurrent operants that are influenced by four variables: rate of reinforcement, quality of reinforcement, immediacy of reinforcement, and effort required to display the target response (McDowell, 1988). Applications of these reinforcement and response parameters have demonstrated the effects of concurrent reinforcement contingencies on

response allocation (Horner & Day, 1991; Mace, Neef, Shade, & Mauro, 1994; Martens, Lochner, & Kelly, 1992; Neef, Mace, & Shade, 1993; Neef, Mace, Shea, & Shade, 1992). For example, Neef et al. (1992) showed that both the schedule and the quality of reinforcement influenced time allocation among two concurrently available sets of math problems for 14- to 18-year-old students with mild disabilities. The participants allocated more time to the set of math problems that resulted in the most frequent reinforcement, but only when the quality of reinforcement was identical for each set of problems. When the quality of reinforcement differed across each set of problems, marked departures from the expected allocation of behavior occurred. Neef et al. (1993) further examined the interactive effects of amount, quality, and delay in reinforcement on time allocation across two concurrently available sets of math problems with 13- to 19-year-old students who had mild disabilities. When the length of delay to reinforcement was unequal, the partici-

pants' choices were biased in favor of the math problems that resulted in the most immediate access to reinforcement, regardless of rate of reinforcement. When quality of reinforcement was considered along with delay, idiosyncratic biasing occurred, with 1 individual more affected by quality and the other by delay.

Horner and Day (1991) conducted the first application of concurrent operants with aberrant behavior in a series of experiments that analyzed the effects of response effort, schedule of reinforcement, and delay of reinforcement with participants who had severe to profound mental retardation. In the first experiment, the authors varied the response effort required for obtaining reinforcement via manding. This was accomplished by requiring the participant to sign one word versus an entire sentence prior to receiving breaks from difficult tasks. In the second experiment, the authors evaluated the effects of the schedule of reinforcement by varying the number of aberrant responses versus mand responses required prior to receiving breaks from difficult tasks. In the third experiment, the authors evaluated the effects of delay in reinforcement by varying the amount of time that elapsed following an aberrant response versus a mand response and the delivery of reinforcement. Across all experiments, the participants engaged in the response that was more efficient, resulted in more reinforcement, or resulted in more immediate access to reinforcement, regardless of whether the response was appropriate or aberrant.

The purpose of this investigation was to further analyze choice-making behavior in the context of ongoing displays of aberrant behavior versus manding. Using a concurrent operants framework, we implemented functional communication training (FCT) packages (Carr & Durand, 1985) with young children by providing more reinforcement for mand responses than for aberrant responses. We then analyzed the effects of providing different durations and qualities of reinforcement for two concurrently available response alternatives via choice-making analyses, in which neutral responses were substituted for aberrant responses. Thus, choice making constituted a choice between two or more mands or neutral responses. We applied these analyses to children whose aberrant behavior was severe, and in some cases life threatening, and was maintained by either positive or negative reinforcement. We then assessed whether differential effects occurred based on the class of reinforcement that maintained aberrant behavior. To partially establish the social validity of these assessments, we conducted follow-up probes to assess the stability of treatment.

METHOD

Participants and Settings

Five children were enrolled in the study with the following criteria: The children (a) engaged in inappropriate behavior that was life threatening or posed serious risk to themselves or to others; (b) were under 8 years of age and (c) had been diagnosed with developmental delays, mental disabilities, or chronic health problems such as food refusal, bronchopulmonary dysplasia, or pulmonary hypertension.

Alexander was 22 months old and had been diagnosed with short-bowel syndrome and severe developmental and language delays. He produced vocalizations such a laughing and crying, and although he babbled occasionally, he did not display formal communication. He had been hospitalized for all but 3 months since birth for multiple surgeries to lengthen his bowel and to insert a central venous line, from which he received medication and intermittent nutrition. At the time of this investigation, Alexander was an inpatient awaiting further surgery to lengthen his bowel. Behaviors of concern

were pulling and chewing the tubes attached to his central line and altering the settings on his intravenous infusion pump (IMED). These behaviors were reported to occur approximately 10 times per day and were increasing in frequency. Pulling and chewing on his central lines resulted in central-line infections, which in turn required additional surgeries to replace the infected line. Altering the settings on the IMED resulted in incorrect delivery of medications and nutrition. Alexander exhibited other inappropriate behaviors, such as throwing toys, self-induced emesis, and aggression. All assessment and treatment sessions were conducted in Alexander's room on the inpatient unit. Follow-up sessions were conducted either on the inpatient unit or at Alexander's home.

Cassandra was 16 months old and had been diagnosed with severe pulmonary hypertension, atrial septal defect, bronchopulmonary dysplasia, and developmental and severe language delays. Her medical condition required her to spend all but 3 months in the hospital since birth, and at the time of this investigation, she was awaiting further surgery to correct an atrial septal defect and to have a tracheotomy. Of most concern was her pulling on nasogastric and nasopharyngeal tubes and leads to her heart monitor. These behaviors were reported to occur approximately 10 times per day and were increasing in frequency. Pulling on tubes and monitors resulted in physical restraint by nursing staff that occasionally elevated her heart rate to reportedly dangerous levels. She produced some vocalizations, such as crying, but she did not communicate with words. All assessment, treatment, and follow-up sessions for Cassandra were conducted in the crib in her hospital room.

Lucas was 3 years old and had been diagnosed with failure to thrive due to chronic food refusal and emesis. Lucas was below the 5th percentile in weight for his age, but no medical disorders had been diagnosed that would preclude him from taking food orally. Lucas was verbal but had been diagnosed with a mild receptive language delay. His medical condition required admission to the hospital on at least two previous occasions for complications, such as dehydration and respiratory arrest. At the time of this investigation, Lucas was an inpatient at the hospital to further evaluate his food refusal (turning his head away from the spoon, kicking, screaming, spitting out food, vomiting). These behaviors occurred at every meal and were increasing in severity. Upon admission, a temporary intervention package was implemented during meal times to increase his food acceptance. This package consisted primarily of escape extinction (i.e., when a bite of food was presented, it was not removed unless it was eaten) and differential reinforcement of appropriate behavior (i.e., praise and access to preferred foods were provided contingent on accepting a bite of food). Sessions for Lucas were conducted in a play room located on the inpatient unit or in a high chair in his hospital room.

Maxwell was 4 years old and engaged in severe self-injury (head hitting and head banging) and tantrums. Maxwell's day-care providers reported that, as a result of the frequency and severity of his inappropriate behavior, mechanical restraint (e.g., a chair tie) was used when Maxwell was required to participate in nonpreferred tasks. When no demands were placed on him, he was allowed to roam freely in the classroom. Maxwell was diagnosed with a severe developmental delay. Maxwell independently signed or said "done" to receive breaks from nonpreferred activities at home. With prompting, Maxwell also signed or said "please" to request parental attention and toys at home. However, he did not display these mands in the day-care setting. Sessions for Maxwell were conducted in his classroom at a local preschool day-care facility. Maxwell's class consisted of a lead teacher, two teaching asso-

ciates, and 12 children (nine of whom had disabilities).

Kevin was 2 years old and had been diagnosed with failure to thrive. Behaviors of concern were severe noncompliance and aggression. When his mother required him to participate in nonpreferred activities, such as cleaning up toys or eating a meal, Kevin usually cried, hit, kicked, or bit his mother. These behaviors were increasing in frequency and intensity. His noncompliance during meals resulted in low weight, for which he was admitted to the hospital. He displayed several vocalizations that approximated words, but many of these vocalizations were not understandable to others. The first 14 sessions for Kevin were conducted while he was an inpatient, with the remainder of the sessions conducted in his home following discharge from the hospital.

Materials

The items for Alexander were a soft stuffed ball and a round red contact microswitch (20 cm in diameter) that was connected to a cassette recorder. The microswitch was later connected to a tape recorder that activated the pretaped message, "Somebody come here, please!" The items for Cassandra were a soft stuffed ball that contained a rattle and a hard plastic ball that contained a bell. The items for Lucas were two childsized spoons, one with a red handle and one with a blue handle. The items for Maxwell were a "done" card made of laminated red construction paper (20 cm by 10 cm) and materials from a variety of tasks, such as a dominoes, blocks, and puzzles. The items for Kevin were a "play" card made of laminated blue construction paper (20 cm by 15 cm) and materials from a variety of tasks, such as blocks, trucks, and toy tools.

Response Definitions

Four types of target behavior were recorded for each participant: (a) *primary inappro-*

priate responses, which were defined as self-injurious and aggressive behaviors that the care providers identified as being of most significant concern; (b) *other inappropriate responses,* which were more mild inappropriate behaviors, such as noncompliance, screaming, or destroying toys; (c) *choice responses,* which were defined as mands (e.g., gestures, manual signs, or verbalizations) that were followed by contingent reinforcement; and (d) *appropriate responses,* which consisted of appropriate play and work behaviors.

Alexander. The primary inappropriate response for Alexander was line pulling or chewing, defined as any part of Alexander's hand or mouth touching the surgical tubing that led to his central line for more than 2 s, or any part of Alexander's hand touching the IMED for more than 1 s. Other inappropriate responses for Alexander were toy throwing (releasing a toy outside his crib or playpen), crying, and hitting. The choice responses selected for Alexander were touching the microswitch or the ball for at least 1 s.

Cassandra. The primary inappropriate response for Cassandra was tube or lead pulling, which was defined as Cassandra's hand coming in contact with the tubes attached to her body, or with any other medical apparatus used to attach tubes or leads to her body, for more than 2 s. Other inappropriate responses for Cassandra were crying and pulling her own hair. The choice responses consisted of touching one of two balls for at least 1 s or with sufficient force to cause it to ring or rattle.

Lucas. The primary inappropriate response for Lucas was actively refusing a spoon. Active refusal was defined as turning his head from the spoon, pushing the spoon from his mouth, throwing the spoon, or coughing and gagging when the spoon was presented within 5 cm of his mouth. Other inappropriate responses consisted of crying and noncompliance, defined as attempting

to climb out of the high chair. The choice responses consisted of saying, "I want the [red or blue] spoon," or touching one of two stimuli (a red spoon or a blue spoon) for at least 1 s. The mand responses consisted of saying, "I want to play," or "Come here."

Maxwell. The primary inappropriate response was head hitting, defined as his hand making forceful contact with his head. Other inappropriate responses were aggression (hitting other children or an adult), noncompliance (pulling away from an adult or kicking task materials), toy throwing, and crying. The choice responses were defined as touching either the "done" card or a piece of a task that was presented by the teacher for at least 1 s.

Kevin. The primary inappropriate response for Kevin was aggression, defined as biting or hitting another person. Other inappropriate behaviors consisted of noncompliance, defined as running from the work area, pulling away from an adult, kicking the task materials away from himself, and crying. The choice responses consisted of either touching the "play" card, saying "play," or touching a piece of a task that was presented by the teacher for at least 1 s.

Adult responses. Five types of adult responses were recorded: (a) *providing choices,* (b) *choice prompts,* (c) *task prompts,* (d) *social interactions,* and (e) *redirection or block.* Providing choices occurred when the adult held two neutral stimuli within 30 cm of the participant for at least 1 s and said, "Which one do you want?," "You choose," "Your choice," or "Do you want the [object] or the [object]?" Choice prompts were defined as the adult indicating to the participant which stimulus to select (e.g., the adult said, "Choose the [object]" or placed the child's hand on one of the stimuli). A task prompt occurred when the adult directed the child to an activity by saying, "It's time to come back to work," "Take a bite," or by providing physical guidance to pick up an object.

Social interaction was defined as positive social contact with the child, such as praise, discussion of toys and play activities, hugs, tickles, and smiles. A redirection or block was defined as the adult interrupting a child's inappropriate response by restricting his or her movement (e.g., holding his or her hands down) or guiding the child's movement to an appropriate response (e.g., removing his or her hands from a medical apparatus and placing them on a toy that was not associated with a choice response).

Data Collection and Interobserver Agreement

Child and adult responses were recorded by trained observers using a 10-s partial-interval recording system. Seventy-nine percent of the sessions were videotaped and scored later, and the remainder were scored during the session. Interobserver agreement checks were conducted on 48% of the videotaped sessions and 10% of the remaining sessions (36% of all sessions). Agreement checks were distributed across experimental phases as follows: experimental analyses (45%), FCT (35%), choice making (35%), and follow-up (36%). All agreement checks were conducted simultaneously but independently by two observers. Interobserver agreement was calculated using an interval-by-interval agreement ratio (Kazdin, 1982). Agreements were scored only when both observers scored the same behavior as occurring in the same interval. Nonoccurrences, behavioral codes that neither observer recorded, were not counted as agreements. A disagreement occurred when one observer recorded a behavior not recorded by the other. Agreement was calculated by dividing the number of occurrence agreements by the total number of occurrence agreements plus disagreements and multiplying by 100%. Interobserver agreement averaged 93% for all response measures.

Experimental Design

The study consisted of three phases: (a) an experimental analysis, (b) a choice-making analysis, and (c) follow-up probes of treatment. For the experimental analyses, multielement designs were conducted that involved manipulation of antecedent or consequence variables. For Maxwell, a brief experimental analysis (Cooper et al., 1992) was conducted within a multielement design. For all children, two or more environmental conditions were alternated across sessions.

The choice-making analyses were conducted within a combination reversal and concurrent schedules design. The reversal design involved varying the duration and quality of reinforcement provided for each of two response alternatives. Within each condition, the relative duration and quality of reinforcement provided for each response alternative also varied. Following the choice-making analysis, follow-up treatment probes were conducted intermittently for up to 6 months.

General Procedures

Phase 1: Experimental analysis. Prior to conducting the experimental analyses, a descriptive assessment (Repp, Felce, & Barton, 1988) was conducted with the primary care providers to identify situations in which inappropriate behavior either rarely or commonly occurred and what the care provider's typical response was to inappropriate behavior. This information was used to formulate hypotheses about the contingencies that maintained inappropriate behavior. Subsequent experimental analyses were then conducted to test these hypotheses.

At least one of two versions of an experimental analysis, sometimes referred to as antecedent and functional analyses (Axelrod, 1987), was completed for each participant. For Alexander, Cassandra, and Maxwell, an antecedent analysis was first conducted (a) as preliminary tests of our hypotheses, and (b) to identify whether other, less severe forms of inappropriate behavior occurred under the same conditions as the primary inappropriate behavior. An antecedent analysis was not conducted for Lucas because he did not display problem behavior outside of meals. An antecedent analysis was not conducted for Kevin because the primary reason for his admission to the hospital was for food refusal and because his admission lasted only 14 days.

The antecedent analysis, based on Carr and Durand (1985), was designed to test the effects of two types of antecedent conditions on the participant's behavior: attention (high or low) and demand (high or low). During high-attention conditions, the participants received continuous adult attention while playing with toys, and during low-attention conditions, adult attention was diverted from the participant while the participant played with toys. During high-demand conditions, the participants were required to participate in a nonpreferred task, and verbal and physical prompts were delivered every 5 s to 10 s throughout the session. During low-demand conditions, the participants were allowed to participate in a task of their choice, and no verbal or physical task prompts were provided. Conditions were 5 min in duration and were counterbalanced. An average of six sessions (range, four to eight) were conducted per day for each participant.

A functional analysis was conducted with participants who (a) displayed non-life-threatening problem behavior or (b) displayed a high-rate non-life-threatening behavior that we hypothesized to be in the same response class as the life-threatening behavior. A functional analysis was conducted with Alexander, Lucas, and Kevin. A brief functional analysis was conducted for Maxwell because a functional analysis had al-

ready been completed in his home prior to this investigation. A functional analysis was not conducted with Cassandra because, although she did display some topographies of inappropriate behavior that were not life threatening (e.g., pulling her hair and crying), these behaviors occurred at a very low rate (i.e., less than once per session).

The functional analysis, based on Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), involved two classes of consequence variables: positive reinforcement (access to attention and preferred toys) and negative reinforcement (escape from task demands). During positive reinforcement conditions, access to attention was withheld unless inappropriate behavior occurred. Engagement in inappropriate behavior resulted in 10 s to 20 s of attention. The negative reinforcement conditions were conducted in the same way as the demand condition in the antecedent assessment, except that the participants were provided with 10-s to 20-s breaks from the task demands contingent on the occurrence of inappropriate behavior. In addition to the positive and negative reinforcement conditions, a free-play condition was conducted as a control condition. In this condition, the participants were allowed to play with preferred toys with an adult, and no demands were placed on them. Sessions were 5 min in duration and were counterbalanced. An average of six sessions (range, four to nine) were conducted per day for each participant.

Phase 2: Choice-making analysis. The choice-making analysis was conducted in two steps: (a) FCT and (b) choice making. FCT was conducted only with participants who were taught a manding response that was not currently in their repertoire (Alexander, Maxwell, and Kevin). During FCT, the participants were taught mands that resulted in the same class of reinforcement that had been identified as maintaining inappropriate behavior in the experimental analysis. To produce a strong intervention effect, the participant was provided with a longer duration and higher quality of reinforcement for the appropriate response (e.g., 1 to 2 min of high-quality reinforcement was provided for the appropriate response vs. 10 s of low-quality reinforcement for the inappropriate response). During this phase, training initially involved verbal or physical prompts to exhibit the mand to obtain reinforcement. During the first two trials of the first session, physical prompts to display the mand were provided. After the first two trials, verbal prompts were provided every 30 s, and no further physical prompts were delivered. On subsequent sessions, a verbal prompt was provided prior to beginning the session, and verbal prompts were delivered every 30 s if the child did not display the mand response independently. Inappropriate behavior resulted in brief, neutral redirection to block the behavior, which in turn resulted in either brief attention or brief breaks from task demands. Thus, both appropriate and inappropriate behavior received some reinforcement. Each FCT session lasted 10 to 15 min and was conducted once or twice per day until the participant displayed the mand independent of prompting for two consecutive sessions.

The choice-making analysis was conducted to analyze further the effects of duration and quality of reinforcement on the participants' choice-making behavior. The choice-making analysis was a necessary step in arriving at an effective intervention because it allowed us to verify that the participants chose to display the mand response rather than the inappropriate response as a result of the reinforcement contingencies for each response. That is, the choice-making analyses allowed us to demonstrate that the participants' responses would vary as a function of the duration and quality of reinforcement provided to them. Because we were unwilling to manipulate the duration and quality

of reinforcement provided for life-threatening behaviors, such as line pulling, we introduced a second response alternative, termed the *neutral response,* for the choice-making analysis. Each response alternative, mand or neutral, was associated with a specific stimulus (microswitch and ball for Alexander, rattle and bell for Cassandra, red and blue spoons for Lucas, "done" card and task materials for Maxwell, and "play" card and task materials for Kevin). For the first condition, one stimulus was always associated with six times the duration of reinforcement and a higher quality of reinforcement than the other. This condition continued until the participant consistently chose the stimulus associated with the longer duration and higher quality of reinforcement for at least two consecutive sessions. The reinforcement contingencies were then reversed across stimuli during the next condition (a longer duration and higher quality of reinforcement was associated with the alternative stimulus). When the participant again selected the stimulus associated with the longer duration and higher quality of reinforcement for at least two consecutive sessions, the third condition was implemented; the duration and quality of reinforcement for each stimulus was reversed again.

During both FCT and choice making, trials constituted opportunities to receive reinforcement. If the participant's behavior was maintained by attention, a trial began when the care provider diverted his or her attention and ended when reinforcement was received. The first response displayed by the participant, whether a mand, an appropriate response, or an inappropriate response (FCT only), was recorded, and the duration and quality of attention associated with that response were delivered. The next trial began as soon as reinforcement was discontinued (i.e., the care provider turned away). For negative reinforcement, each trial began with task prompts and ended with breaks (escape)

from task demands. During FCT, the number of trials per session varied depending on the participants' choices. If the participant chose the response associated with the longer duration and higher quality of reinforcement (e.g., 1 to 2 min of attention vs. 10 s of attention), approximately five to seven trials were conducted per session. However, if the participant chose the response that was associated with the shorter duration and lower quality of reinforcement, more trials (range, 8 to 25) were conducted per session.

Prior to each choice-making session, the experimenter verbally prompted the participant to select the stimulus associated with the longer duration and higher quality of reinforcement. In addition, prior to the first session in each new phase, the experimenter physically prompted the participant to select the stimulus associated with the longer duration and higher quality of reinforcement. Then, the experimenter held both stimuli within 30 cm of the participant's hands and said, "Which one do you want? Your choice." The position of the stimuli was counterbalanced across trials (each choice response) and sessions. If the participant did not select one of the stimuli, the experimenter continued to hold the stimuli and repeated the choice prompt about every 30 s until the participant selected one stimulus. The longest duration of prompting was 2 min. During choice making only, all inappropriate behavior was either prevented (e.g., by removing the lines) or ignored. Sessions were 15 min in duration, and an average of three sessions (range, two to seven) were conducted per day.

Phase 3: Follow-up treatment probes. A treatment package based on the results of the choice-making analysis was implemented by care providers. Two general treatment packages were used. The first treatment, used for Alexander, Cassandra, and Maxwell, was choice making and consisted of training the participant to mand for reinforcement. This

intervention was identical to the FCT procedures used in Phase 2. The second treatment package, used for Kevin and Lucas, was choice making plus differential reinforcement of appropriate behavior (DRA). This treatment package consisted of providing variable durations and qualities of reinforcement for mand responses, but the participants were allowed to choose between activities that required variable amounts of effort before gaining access to reinforcement. The participants chose between longer duration and higher quality of reinforcement, which was associated with a more difficult task, or shorter duration and lower quality of reinforcement, which was associated with a less difficult task. Follow-up probes were 10 min to 20 min in duration, and an average of two sessions (range, one to three) were conducted per day across participants for 1 to 6 months.

Specific Procedures

Alexander. The descriptive assessment revealed that line pulling sometimes resulted in alarms sounding and consistently resulted in attention being provided either to reprimand or to distract Alexander. Therefore, our hypothesis was that attention maintained his inappropriate behavior. An antecedent analysis, consisting of high- and low-attention conditions, was conducted to verify this hypothesis. During the antecedent analysis, Alexander was in his crib or playpen and was connected to false lines so that line-pulling and line-chewing behavior could be ignored.

Inappropriate behaviors, such as crying and toy throwing, co-occurred with line pulling during the low-attention conditions; therefore, we hypothesized that these topographies of inappropriate behavior were also maintained by attention. We were able to conduct a subsequent functional analysis on topographies of inappropriate behavior other than line pulling, which allowed us to avoid

providing reinforcement contingent on a life-threatening behavior. The functional analysis consisted of free-play and contingent attention conditions that were conducted while Alexander's lines were securely taped to his body and the tubes were disconnected from the IMED.

During FCT, the false lines were removed and replaced with authentic ones. Alexander was placed in his crib and taught to press a red microswitch that activated the pretaped message, "Somebody come here, please." FCT was conducted by various adults including Alexander's mother, father, nurse, and the experimenters. Upon leaving the hospital room, the adult reminded Alexander that if he touched the microswitch, someone would play with him. If Alexander touched the microswitch, an adult entered his room, greeted him enthusiastically, and played with him in his crib for 2 min. If Alexander did not touch the microswitch but played quietly in his crib, the adult reappeared about every 30 s and briefly told him that he could touch the microswitch if he wanted to play. If Alexander pulled or chewed on his lines, the adult entered the room to remove his hands from the lines but did not make eye contact or talk to him. Thus, both line pulling and touching the microswitch resulted in attention. However, the duration and quality of reinforcement for each of these responses varied. All other inappropriate behaviors, such as toy throwing, were placed on extinction (i.e., they were ignored).

The choice-making analysis was conducted by the experimenters in Alexander's room while he was in his playpen. During choice making, the microswitch and the ball were associated with concurrent reinforcement durations and qualities similar to those used in FCT. During the first phase, the pretaped message that was activated by touching the microswitch resulted in 1 min of attention and toy play; the ball was associated with 10

s of attention followed by 50 s of being ignored. During the second phase, Alexander received 1 min of attention for touching the ball and only 10 s of attention for activating the switch. The third phase replicated the first phase. During all choice-making sessions, Alexander was attached to false lines. Both line pulling and other inappropriate behaviors, such as toy throwing, were placed on extinction.

During follow-up probes, the choice-making/FCT package was implemented, but with the false lines removed and the authentic lines attached. If Alexander pressed the switch, he received approximately 2 min of enthusiastic attention. If he pulled on his lines, he received approximately 10 s of neutral redirection and was then ignored. The first 11 follow-up probes were conducted in the hospital by the experimenters and Alexander's parents, with six additional probes conducted in his home by his mother after he was discharged from the hospital. The microswitch was available for all but the last session. During the final session, the microswitch was no longer used because Alexander began to verbalize "Mom," and "Mom" was used as the mand rather than touching the microswitch.

Cassandra. The descriptive analysis revealed that line and tube pulling usually resulted in alarms sounding, which in turn resulted in care providers entering the room, connecting the tubes and lines, and talking or playing with her. Therefore, our hypothesis was that attention maintained Cassandra's line- and tube-pulling behavior. Thus, an antecedent analysis that consisted of high- and low-attention conditions was conducted, as with Alexander. Cassandra, however, was attached to her leads and tubes throughout all sessions. All tube- and lead-pulling behaviors were ignored, unless Cassandra detached them. When this occurred, the experimenter or a nurse replaced the leads but did not make eye contact with or

speak to Cassandra. If Cassandra pulled out her nasogastric or nasopharyngeal tubes, a nurse replaced the tubes without making eye contact or speaking to Cassandra, and the session was terminated. This occurred twice.

The choice-making analysis was conducted by the experimenters when Cassandra was in her crib in the same manner as with Alexander, except that two balls were used for choice making. During the first and third phases, the ball with the bell was associated with the most reinforcement, and during the second phase, the ball with the rattle was associated with the most reinforcement. All inappropriate behavior was placed on extinction.

During follow-up probes, a choice-making/FCT package was implemented. If Cassandra picked up the ball that contained the bell, she was provided with at least 2 min of enthusiastic attention. If she pulled on her tubes or leads, she received neutral redirection and was then ignored. All follow-up probes were conducted by the experimenters in Cassandra's crib at the hospital.

Lucas. The descriptive analysis revealed that inappropriate behavior occurred only rarely outside of mealtimes and that mealtime constituted the only consistent demand placed on him. Thus, we hypothesized that escape from demands maintained his problem behavior. Because an intervention consisting partially of escape extinction was currently in place, we conducted the functional analysis of his manding outside of mealtimes rather than on his inappropriate behavior during meals. During the functional analysis, "I want to play" was used as the target behavior for contingent attention, and "Come here" was used as the target behavior for contingent escape. During the free-play condition, toys and continuous attention were provided, and no demands were placed on him regardless of whether he manded. In both the contingent attention and contingent escape conditions, Lucas was verbally

prompted to mand every 30 s if he did not independently mand. The functional analysis was conducted by the experimenters in Lucas' hospital room.

The choice-making analysis was conducted by the experimenters and Lucas' mother when Lucas was in the high chair in his hospital room. Eating utensils such as spoons, a plate, and a cup were present, but no food was placed on or in them. The empty red spoon and the empty blue spoon were associated with concurrent reinforcement durations and qualities. No other toys were available. During the first phase, the red spoon was associated with 1 min of attention, and the blue spoon was associated with 10 s of attention followed by 50 s of being ignored. During the second phase, Lucas received 1 min of attention for the blue spoon and only 10 s for the red spoon. The third phase replicated the first phase. If Lucas chose one of the spoons but did not put it in his mouth, the experimenter held the spoon near his mouth (escape extinction) but otherwise ignored him. As soon as Lucas put the spoon in his mouth, the contingency associated with that spoon was implemented (i.e., 1 min of attention was delivered, or he was provided with 10 s of attention and ignored for 50 s).

During follow-up probes, a choice-making/DRA treatment package, consisting of providing positive reinforcement for appropriate eating and escape extinction for noncompliance, was implemented but was modified to include the red and blue spoons (each spoon contained equal bites of food, such as yogurt) and increased reinforcement (attention) for independent eating. Sessions were conducted in Lucas' high chair in his hospital room. His mother verbally prompted him to take a bite of food. If he picked up the red spoon with food on it and put it in his mouth within 5 s of the prompt, he was provided with enthusiastic attention until he swallowed or for 1 min, whichever oc-

curred first. If he did not swallow within 1 min, he was ignored until he took another bite. If he did not pick up the spoon within 5 s of the prompt, or if he engaged in any inappropriate behavior such as crying, his mother used the blue spoon to place a bite of food in his mouth using escape extinction. Lucas received approximately 10 s of attention while the bite was delivered, but was ignored while he chewed.

Maxwell. The descriptive analysis revealed that Maxwell frequently engaged in inappropriate behavior if he was required to pick up his toys or if he was required to play with toys in a specific way. If Maxwell was not required to participate in a specific activity (i.e., he was allowed to wander around the classroom), he rarely engaged in inappropriate behavior. An antecedent analysis was conducted to test the hypothesis that self-injury was occasioned by task demands. It consisted of two phases and was conducted in Maxwell's classroom. The first phase compared the effects of high-demand versus low-demand tasks while continuous attention was provided. The second phase compared the effects of high attention versus low attention under low demands. Sessions were conducted by Maxwell's teacher and the experimenters using materials normally available in the classroom. All occurrences of self-injury and other inappropriate behaviors were ignored or blocked.

Given the results of the antecedent analysis and the functional analysis that had been completed in Maxwell's home prior to this study, the brief functional analysis compared only free-play and escape conditions. This analysis was conducted in an outpatient clinic in the hospital by Maxwell's parents with coaching from the experimenters.

FCT was conducted by Maxwell's teacher in his classroom. During FCT, Maxwell was taught to sign "done" or touch a "done" card to obtain breaks from demanding tasks. When the "done" card was presented, it was

paired with the word "done," and either touching the card or stating the word "done" was accepted as a mand. If Maxwell manded, he was provided with a 30-s break from the task. At the end of 30 s, Maxwell was prompted to return to work. If he manded again, he was allowed to stay on break. If Maxwell did not mand or engaged in self-injury, he received a brief break while his self-injury was blocked. Thus, both inappropriate behavior and touching the "done" card resulted in breaks. However, the duration and quality of reinforcement for each of these responses varied.

The choice-making analysis was conducted in Maxwell's classroom by his teacher and the experimenters. During choice making, touching the "done" card and touching the task were associated with concurrent reinforcement schedules similar to those used in FCT. During the first phase, touching the "done" card was associated with a 1-min break from task demands, during which Maxwell was allowed to play with his teacher. Touching the task was associated with completing one step of the task (task compliance) followed by a 10-s break, during which Maxwell was required to sit alone. During the second phase, Maxwell received a 1-min break if he touched and completed one step of the task and only a 10-s break for touching the "done" card. The third phase replicated the first phase. During the choice-making analysis only, all occurrences of self-injury and inappropriate behavior were ignored or blocked.

During follow-up probes, which were conducted in his classroom, Maxwell was presented with a nonpreferred task. After he briefly complied with task prompts, he was provided with a break contingent on signing or saying "done." The length of time that Maxwell was allowed to spend on break varied; he was given a 1-min break if he played with peers and toys or a 10-s break if he played alone with toys. This treatment was

intended to increase his social interaction with peers while maintaining increased compliance with task demands and decreased inappropriate behavior. Self-injury and other inappropriate behaviors were blocked and resulted in more prompts to complete the task.

Kevin. The descriptive analysis revealed that Kevin's inappropriate behavior occurred most frequently when his mother required him to pick up his toys or to play with toys in a specific manner. Thus, our hypothesis was that negative reinforcement maintained his problem behavior. The functional analysis consisted of the following conditions: free play, attention contingent on inappropriate behavior, and escape contingent on inappropriate behavior. The first 14 sessions of the functional analysis were conducted at the hospital while Kevin was an inpatient. These sessions were conducted by his mother and an experimenter in his hospital room. The remaining sessions were conducted by his mother and the experimenters in his home following his discharge from the hospital.

FCT was conducted in the same manner as for Maxwell, except that Kevin was taught to say "play" or touch a "play" card to obtain breaks from demanding tasks. As with Maxwell, both inappropriate behavior and touching the "play" card resulted in reinforcement. However, the duration and quality of reinforcement for each of these responses varied.

The choice-making analysis was conducted by the experimenters and Kevin's mother in his home and was conducted in the same manner as with Maxwell, with the exception of the "play" card. During choice making, touching the "play" card and touching the task were associated with concurrent reinforcement durations and qualities similar to those used in FCT. All inappropriate behavior was ignored or blocked.

During follow-up probes, a choice-making/DRA treatment package was imple-

mented by Kevin's mother in his home. Kevin was allowed to choose between completing one or two steps of a task (e.g., picking up one or two toys) to receive a 30-s break during which he was required to sit alone, or completing 10 steps of the task to receive the longer break (e.g., 3 min) during which he could play with his mother. Throughout follow-up, the amount of work that Kevin was required to complete in order to receive the longer break increased by 5 to 10 steps each session. The length of break time that Kevin received increased as the amount of work required increased, so that by the final two sessions, Kevin was required to complete a task that took approximately 5 min to complete to receive a 10-min break.

RESULTS

Alexander

The antecedent analysis was conducted across 10 days. Although the occurrence of line pulling was variable (Figure 1), it occurred during a higher percentage of intervals within the low-attention conditions, suggesting an attention function. Other inappropriate behaviors, such as crying and toy throwing (Figure 1), were also variable and did not occur as often as line pulling, but also occurred during a higher percentage of intervals within the low-attention conditions. The functional analysis (Figure 1), conducted for 2 days, resulted in an increase in inappropriate behavior during the contingent attention condition relative to the free-play condition.

FCT was conducted for 5 days (Figure 2). In every session, Alexander touched the microswitch on more than 60% of the trials when the adult diverted his or her attention. During the last three sessions, Alexander touched the microswitch 100% of the time and never engaged in inappropriate behavior.

The choice-making analysis was conduct-

ed for 2 days (Figure 2). During Phase 1, when the microswitch resulted in the longer duration and higher quality of reinforcement, Alexander touched the microswitch almost exclusively. During Phase 2, when the toy resulted in the longer duration and higher quality of reinforcement, Alexander continued to select the microswitch most often during the first two sessions, but he touched the toy more often by the third session. During Phase 3, when the microswitch again received the longer duration and higher quality of reinforcement, Alexander continued to touch the toy during the first session, but by the second session, he selected the microswitch more often than the toy. These results demonstrated that Alexander's choice-making behavior varied as a function of the duration and quality of reinforcement associated with each response option.

Very little inappropriate behavior occurred during the choice-making analysis. During Phase 1, inappropriate behavior occurred during approximately 1% of the intervals. During the first two sessions of Phase 2, a slight increase in inappropriate behavior occurred, but by the fifth session, the occurrence of inappropriate behavior decreased. During the first session of Phase 3, a slight increase in inappropriate behavior was observed, but during Session 13, no inappropriate behavior occurred.

Follow-up probes were conducted over 6 months (Figure 2). Alexander touched the microswitch independently during most of the probes while he was in the hospital. During the first two probes following discharge from the hospital, Alexander independently touched the microswitch less than 20% of the time. However, by the third session following discharge, Alexander independently touched the microswitch during 80% of the intervals. During most sessions, Alexander touched the microswitch almost immediately when the care provider left the room, which resulted in adult attention be-
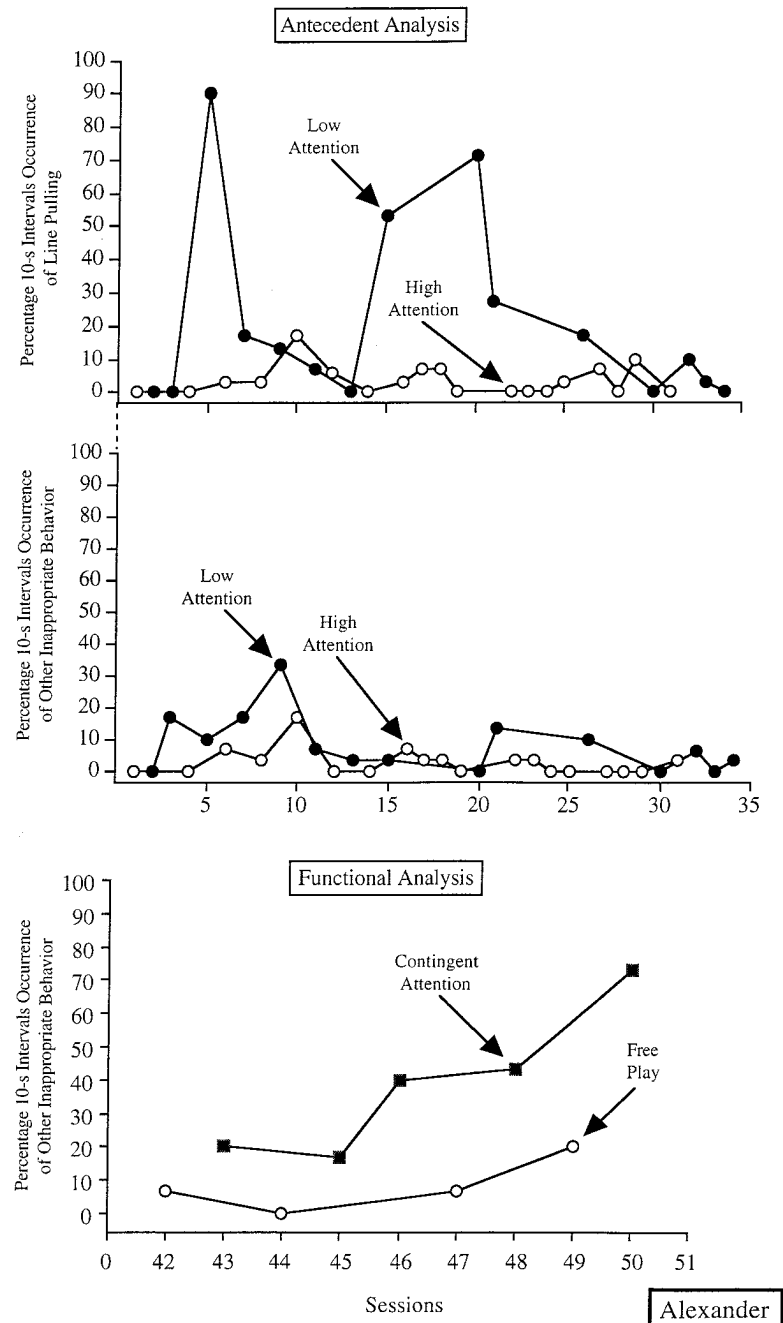
Figure 1.   Top panel: Alexander's percentage of line pulling during the antecedent analysis. Middle panel: Alexander's percentage of inappropriate behavior during the antecedent analysis. Bottom panel: Alexander's percentage of inappropriate behavior during the functional analysis.

ing provided during 50% to 80% of the intervals. In most sessions, minimal inappropriate behavior occurred, and line pulling occurred only in Session 11. A fading pro-

cedure was not implemented because, over time, Alexander occasionally played alone for the majority of the session without either touching the microswitch or engaging in in-
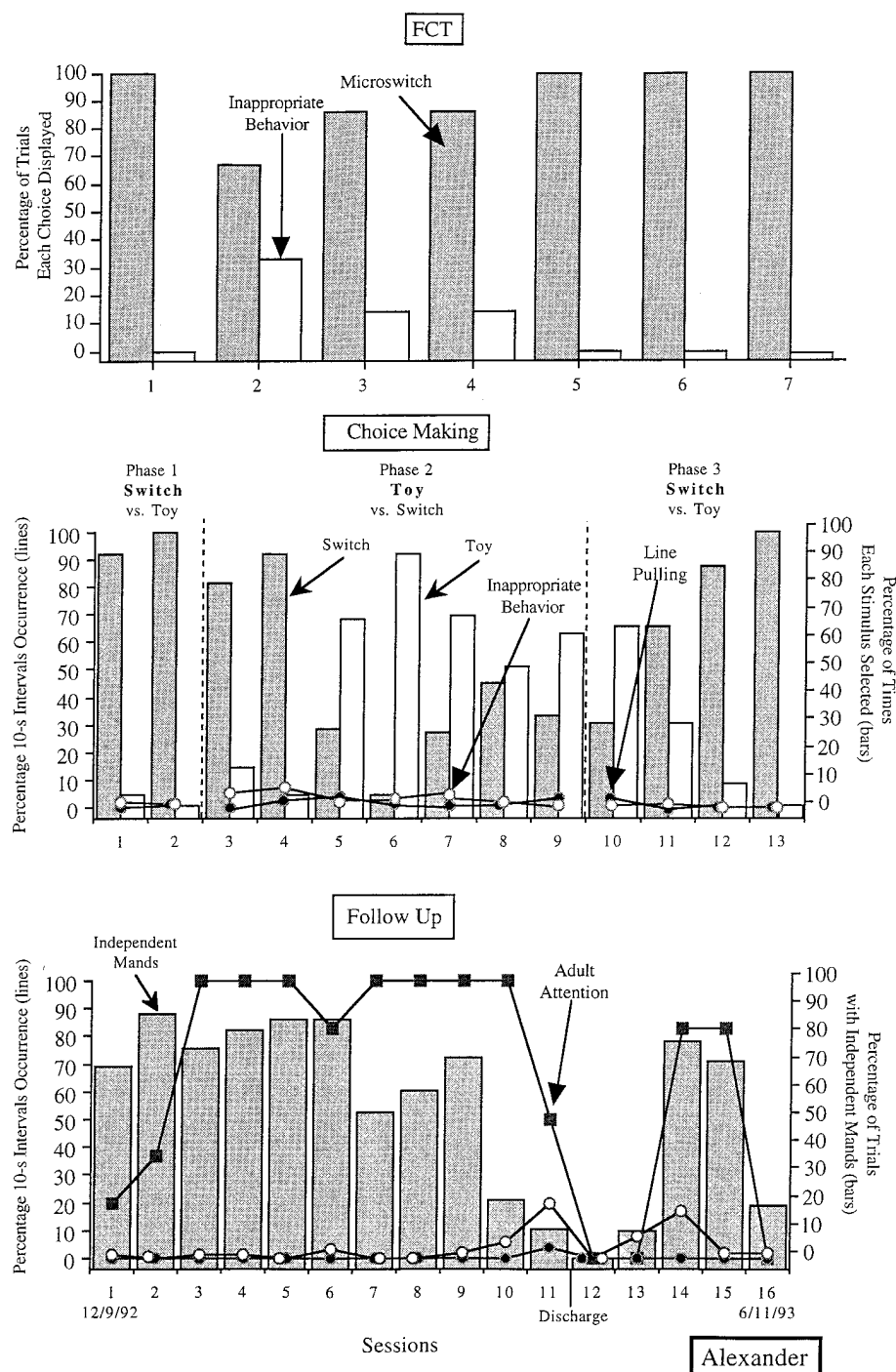
Figure 2. Top panel: The percentage of intervals in which Alexander touched the microswitch and engaged in an inappropriate response during FCT. Middle panel: Alexander's percentage of line pulling and inappropriate behavior (represented by the line graphs) and percentage of times he chose the microswitch versus the ball (represented by the histogram) during the choice-making analysis. Bottom panel: Alexander's percentage of line pulling, inappropriate behavior, and adult attention (represented by line graphs) and independent mands (represented by the histogram) during follow-up probes.

appropriate behavior (e.g., Sessions 12 and 16), suggesting that constant attention was not always needed. Following this study, Alexander was able to stay at home, without readmission to the hospital for central line infections, for the longest period of time since birth.

Cassandra

The antecedent analysis was conducted over 6 days (Figure 3). Tube- and line-pulling behavior was variable during low-attention conditions but rarely occurred during high-attention conditions. These results suggested that inappropriate behavior was related to attention.

The choice-making analysis was conducted over 9 days, with results similar to those obtained with Alexander (Figure 3). During Phase 1, when the bell resulted in the longer duration and higher quality of reinforcement, Cassandra touched the bell more often than the rattle in all sessions. During Phase 2, when the rattle resulted in the longer duration and higher quality of reinforcement, Cassandra touched the rattle more often than the bell in all but three sessions. During Phase 3, the bell again resulted in the longer duration and higher quality of reinforcement. Although Cassandra continued to touch the rattle more often than the bell in the first session, she touched the bell more often in the remaining two sessions. Throughout the choice-making analysis, very little tube- or line-pulling behavior occurred.

Follow-up probes were conducted over 2 months (Figure 3). During the first two probes, Cassandra independently touched the bell during 50% to 65% of the intervals. By the third session, Cassandra independently touched the bell almost immediately when the care provider left the room, which resulted in adult attention being provided during 70% to 95% of the intervals. Over time, Cassandra played alone for up to 40%

of a session without either touching the bell or engaging in inappropriate behavior. By the third session, when she manded independently 100% of the time, no inappropriate behavior occurred, and very little inappropriate behavior was observed throughout the remainder of the follow-up probes. Fading procedures were not implemented and other long-term follow-up information is not available because Cassandra died (for reasons unrelated to her behavior) shortly after the study was completed.

Lucas

The functional analysis of manding was conducted for 2 days during scheduled play sessions that occurred outside of mealtimes (Figure 4). The free-play sessions are not displayed on the graph because Lucas was not required to mand during these sessions. Variable results occurred during the first four sessions; however, Lucas manded for attention during the final four sessions. These results suggested that attention functioned as a reinforcer for his manding behavior.

The choice-making analysis was conducted over 7 days (Figure 4). During Phase 1, when touching the red spoon resulted in the longer duration and higher quality of reinforcement, Lucas always touched the red spoon more often than the blue spoon. During Phase 2, when touching the blue spoon resulted in the longer duration and higher quality of reinforcement, the initial results were variable. During the first three sessions, he continued to touch the red spoon more often than he touched the blue spoon. However, as the phase continued, Lucas consistently touched the blue spoon more often than he touched the red spoon. His behavior was more consistent during Phase 3, when touching the red spoon again resulted in the longer duration and higher quality of reinforcement. Lucas touched the red spoon more often than the blue spoon on all four sessions. Inappropriate behavior rarely oc-
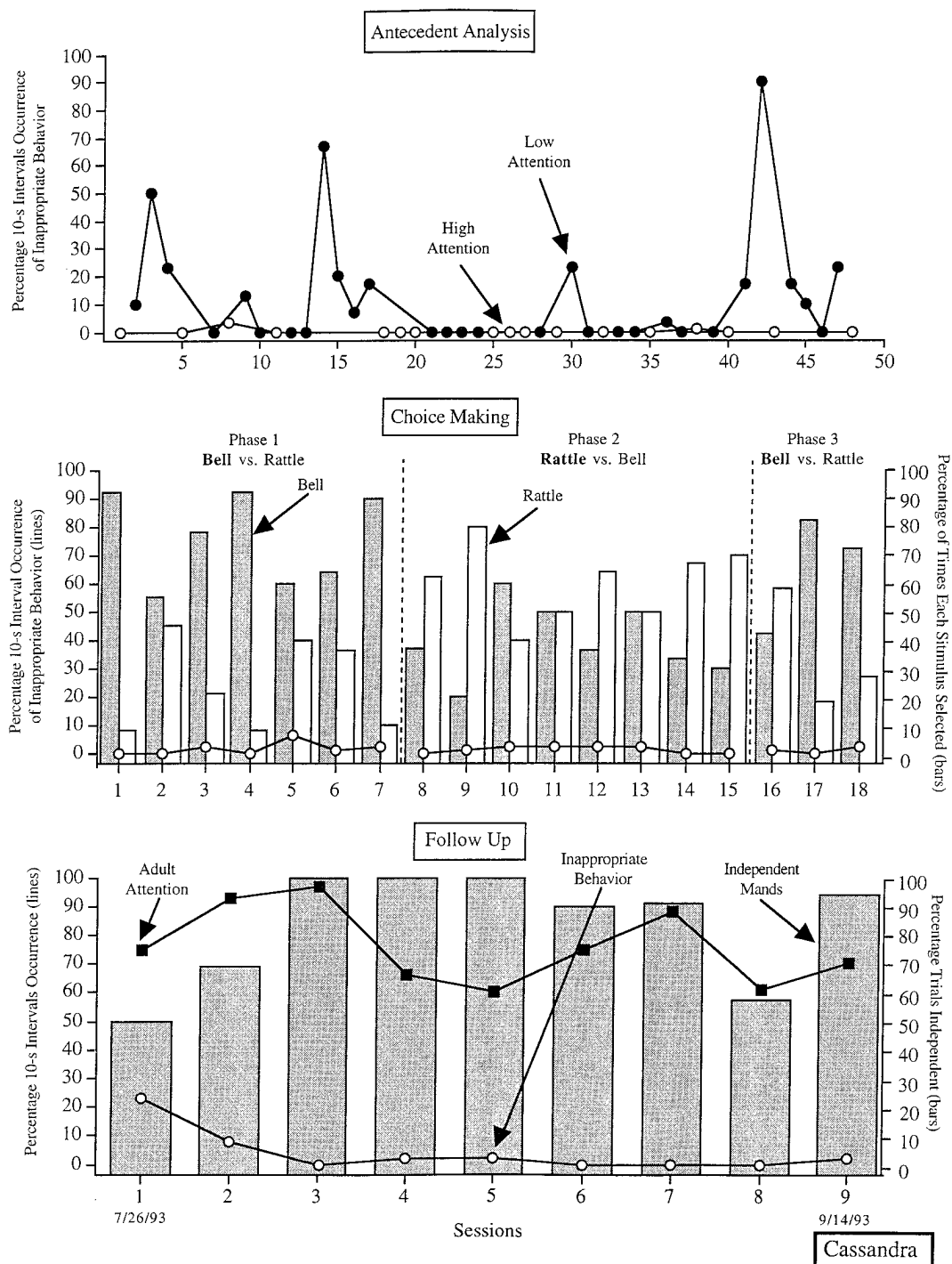
Figure 3. Top panel: Cassandra's percentage of inappropriate behavior during the antecedent analysis. Middle panel: Cassandra's percentage of inappropriate behavior (represented by the line graph) and percentage of times that she touched the bell versus the rattle (represented by the histogram) during the choice-making analysis. Bottom panel: Cassandra's percentage of inappropriate behavior and adult attention (represented by line graphs) and independent mands (represented by the histogram) during follow-up probes.
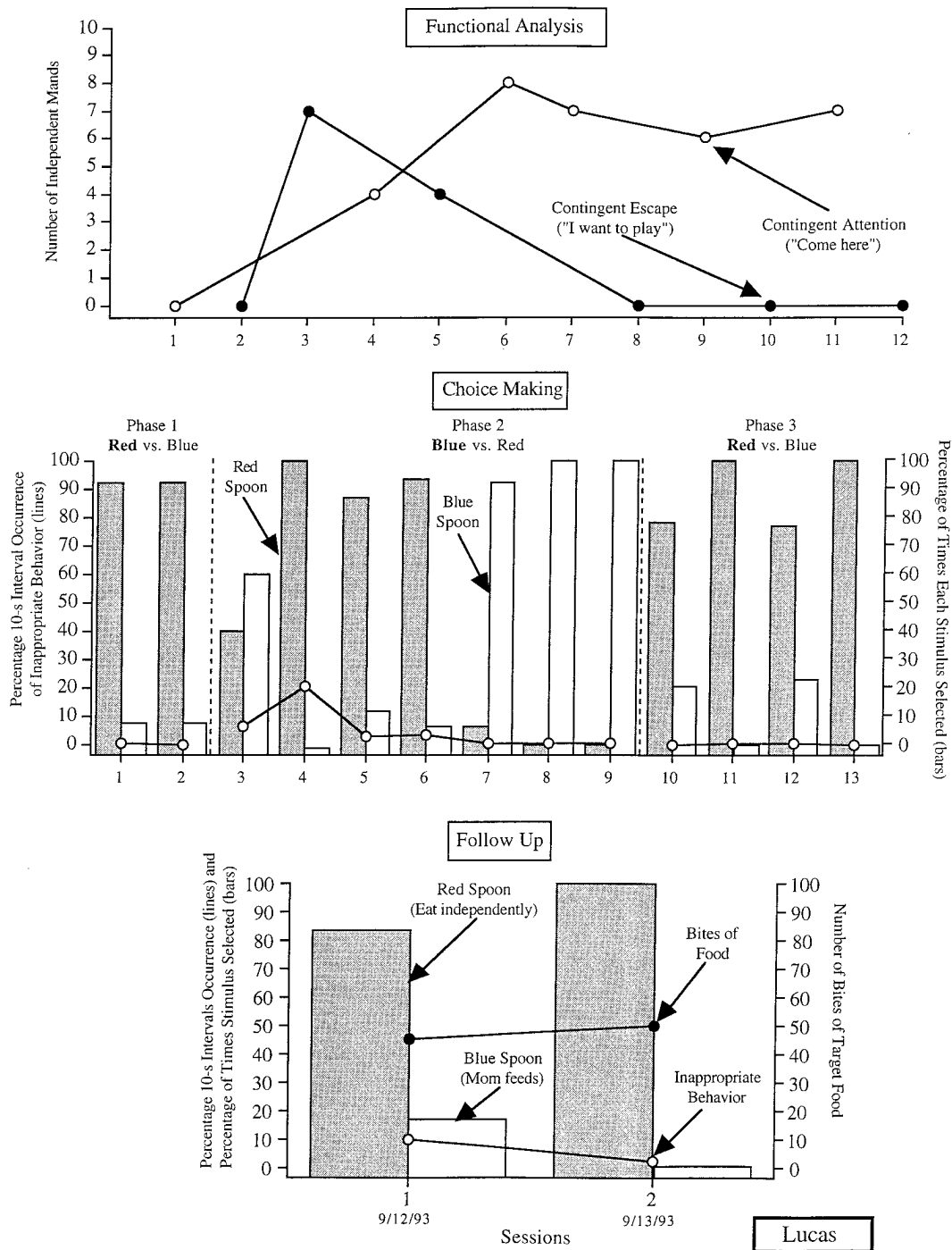
Figure 4. Top panel: Lucas' number of independent mands during the functional analysis. Middle panel: Lucas' percentage of inappropriate behavior (represented by the line graph) and percentage of times he touched the red versus the blue spoon (represented by the histogram) during the choice-making analysis. Bottom panel: Lucas' percentage of inappropriate behavior and number of bites of food (represented by line graphs) and percentage of times he touched the red versus the blue spoon (represented by the histogram) during follow-up probes.

curred except during Session 4, when Lucas exclusively touched the spoon that resulted in the least reinforcement.

The application of the choice-making procedure was demonstrated to the behavioral feeding team during two follow-up probes that were conducted during two meals over 2 days. The results of the treatment package are shown in the bottom panel of Figure 4. During each meal, Lucas most often chose the spoon that resulted in eating independently and receiving the longer duration and higher quality of attention, even though the food items associated with each spoon were identical. Lucas placed the spoon with a bite of high-calorie food in his mouth approximately 40 times and cleaned his plate during each meal. Prior to this analysis, when Lucas was required to eat high-calorie foods, such as meat, potatoes, and even ice cream, he refused to eat and engaged in inappropriate behavior, such as screaming, crying, and emesis. Following discharge from the hospital, Lucas' parents faded their attention to the normal mealtime routine. At follow-up outpatient appointments, his growth was measured to be between the 5th and 10th percentile and was at twice the normal velocity for children his age.

Maxwell

The antecedent analysis was conducted over 4 days (Figure 5). During Phase 1, when high- and low-demand tasks were alternated, Maxwell engaged in the most inappropriate behavior during high-demand tasks. During Phase 2, when high and low levels of adult attention were alternated within low-demand tasks, Maxwell displayed little or no inappropriate behavior. These results supported the hypothesis that Maxwell's inappropriate behavior was maintained by negative reinforcement, which was further supported by the brief functional analysis (Figure 5).

The results of FCT, which was conducted over 2 days, are also depicted in Figure 5. During the first session, Maxwell touched the "done" card or signed "done" on 57% of the intervals and engaged in inappropriate behavior on 43% of the intervals when he was prompted to work. During the next two sessions, Maxwell touched the "done" card or signed "done" on 90% and 100% of the intervals, respectively.

The choice-making analysis was conducted over 8 days (Figure 6). During Phase 1, when touching the "done" card resulted in the longer duration and higher quality of reinforcement, Maxwell initially touched the task a higher percentage of the time (in an apparent attempt to push the task away), but during Sessions 2 and 3, he exclusively touched the "done" card or signed "done." During Phase 2, when touching the task resulted in the longer duration and higher quality of reinforcement, Maxwell initially continued to touch the "done" card, but after the first session, he touched the task appropriately a higher percentage of the time. During Phase 3, Maxwell initially continued to touch the task, but after the first session, he touched the "done" card a higher percentage of the time. Very little inappropriate behavior occurred throughout the choice-making analysis. In all three phases, inappropriate behavior was observed only when Maxwell touched the stimulus that resulted in the shorter duration and lower quality of reinforcement.

Follow-up probes were conducted over 2 days (Figure 6). During each follow-up probe, Maxwell chose to play with peers more frequently than he chose to play alone. After an initial increase in inappropriate behavior, little inappropriate behavior occurred throughout the follow-up probes. Formal fading procedures were not implemented for Maxwell because the school year ended, and he no longer attended the day-care facility on a regular basis. However, his mother reported that, for the first time ever, she was able to take Maxwell
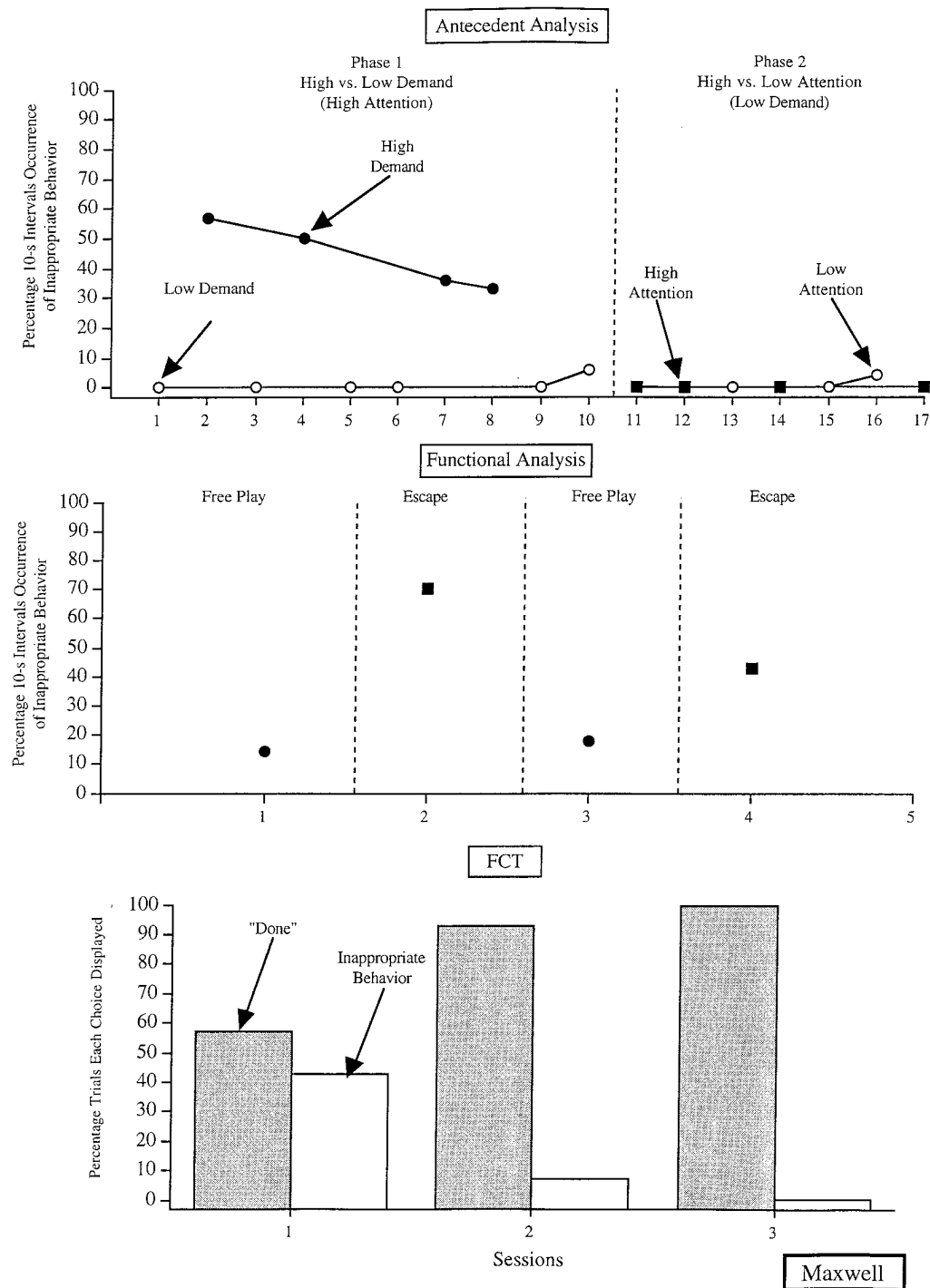
Figure 5.   Top panel: Maxwell's percentage of inappropriate behavior during the antecedent analysis. Middle panel: Maxwell's percentage of inappropriate behavior during the brief functional analysis. Bottom panel: The percentage of intervals in which Maxwell touched the "done" card and engaged in an inappropriate response during FCT.

Choice Making

Phase 1
Mand vs. Task
Compliance

Phase 2
Task Compliance
vs. Mand

Phase 3
Mand vs. Task
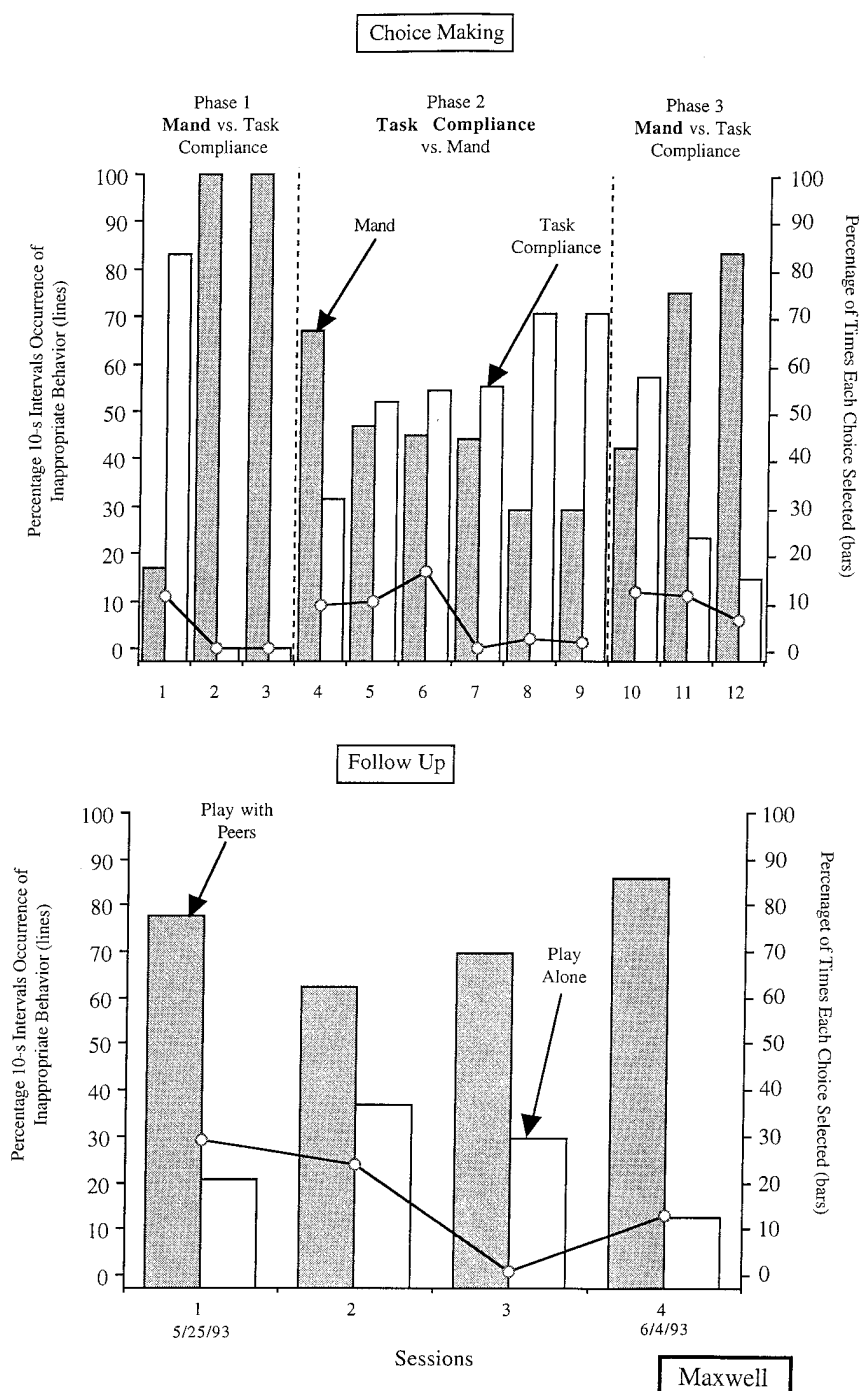Compliance

Follow Up

Maxwell

Figure 6. Top panel: Maxwell's percentage of inappropriate behavior (represented by the line graph) and percentage of times that he touched the "done" card versus complied with the task demand (represented by the histogram) during the choice-making analysis. Bottom panel: Maxwell's inappropriate behavior (represented by the line graph) and percentage of times that he chose to play with peers rather than to play alone (represented by the histogram) during follow-up probes.
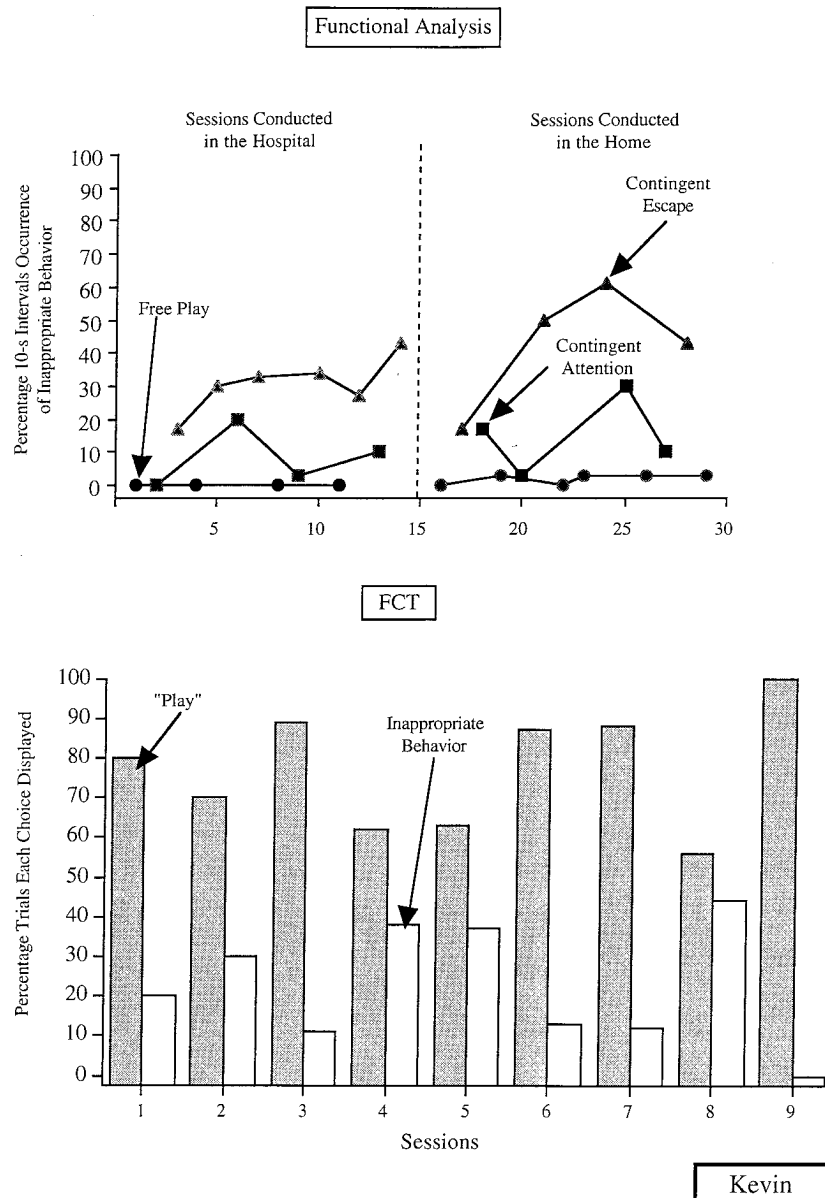
Functional Analysis

FCT

Kevin

Figure 7.   Top panel: Kevin's percentage of inappropriate behavior during the functional analysis. Bottom panel: The percentage of intervals in which Kevin touched the "play" card and engaged in an inappropriate response during FCT.

to another day-care facility while they were on an extended vacation.

Kevin

The functional analysis was conducted over 4 days (Figure 7), with most inappropriate behavior occurring during the escape condition. During attention conditions, the occurrence of inappropriate behavior was variable but low compared to escape. During free play, when no demands were placed on Kevin and adult attention was delivered continuously, minimal inappropriate behavior occurred. This pattern was observed in both

the hospital and the home settings and suggested both escape and attention functions for Kevin's problem behavior.

FCT was conducted for 4 days (Figure 7). During most sessions, Kevin said "play" or touched the "play" card on more than 70% of the intervals when he was prompted to work. During Sessions 4, 5, and 8, however, he engaged in inappropriate behavior in 40% to 50% of the intervals.

During Phase 1 of the choice-making analysis (Figure 8), when the "play" card resulted in the longer duration and higher quality of reinforcement, Kevin touched the "play" card more than he touched the task. During Phase 2, Kevin immediately began to touch the task more than he touched the "play" card. In Phase 3, when the "play" card again resulted in the longer duration and higher quality of reinforcement, Kevin continued to touch the task more often than the "play" card on the first session, but by the second session, he touched the "play" card more than the task. Low levels of inappropriate behavior occurred during all three phases of the choice-making analysis, with most inappropriate behavior occurring during the initial sessions of each new phase.

Follow-up probes were conducted over 6 months (Figure 8). During follow-up, Kevin was provided with a brief break for choosing to complete a small portion of the task or a longer break for choosing to complete a larger portion of a task. During the first four sessions, Kevin was given the choice of putting one or 10 toys away. In every session but Session 2, Kevin chose to put 10 toys away more often than he chose to put one toy away. Initially, a decreasing trend in inappropriate behavior across sessions occurred, but on the fourth session, inappropriate behavior increased and became more severe. The majority of inappropriate behavior occurred when Kevin was told that his break was over and that it was time to return to work. During Sessions 5 and 6, Kevin was

provided with a brief break for choosing to pick up one toy or a long break for choosing to pick up all of his toys (30 to 40 items). During both sessions, Kevin chose to pick up all of his toys, which resulted in only one trial being conducted per session. During these sessions, Kevin's inappropriate behavior showed a decreasing trend and was very mild (e.g., he folded his arms and said "no"). During Session 6, inappropriate behavior occurred only during the first 40 s of the 4 min he spent completing the task, after which no inappropriate behavior occurred. The choice-making/DRA package constituted a natural fading procedure for Kevin. At the end of the study, he was able to complete an entire task before being provided with a break. Anecdotally, his mother reported that for the first time ever, she was able to leave him with a babysitter other than a family member.

DISCUSSION

Choice is measured by response allocation (Logue, 1988), and response allocation varies according to various parameters of reinforcement (Mace, 1994). In the present case, manding, task compliance, and aberrant behavior were shown to be allocated according to the reinforcement dimensions of duration and quality across multiple examples of problematic behavior that varied by topography, severity, function, and setting.

The current study replicated that of Horner and Day (1991) by demonstrating that the reinforcement provided for mands within choice-making/FCT packages can affect the probability that children will mand rather than respond inappropriately. This study extends Horner and Day's study by evaluating the effects of duration of reinforcement provided for mand responses. Horner and Day showed that schedule of reinforcement (e.g., fixed-ratio [FR] 1 vs. FR 3) can affect the probability that an individual will choose
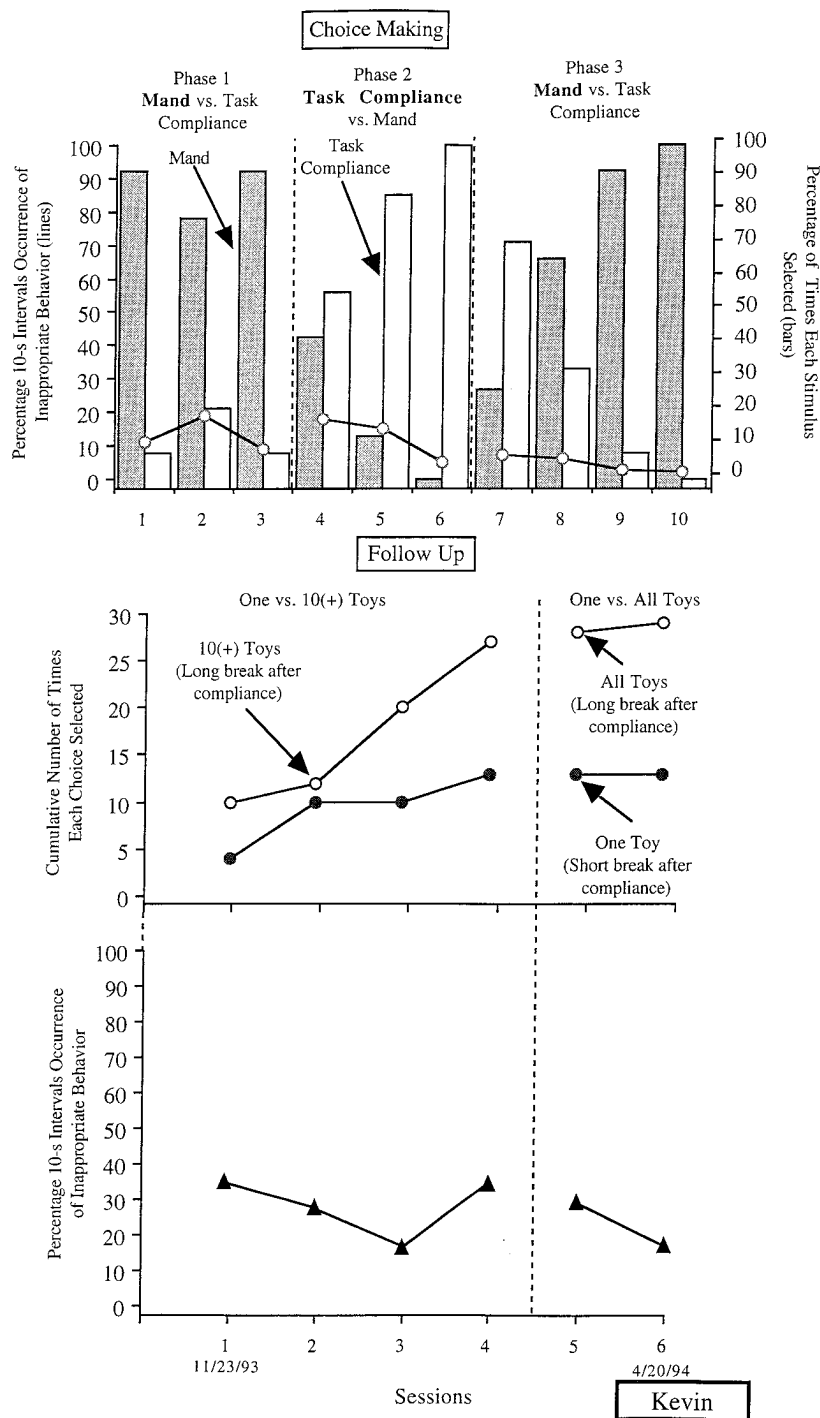
Figure 8.   Top panel: Kevin's percentage of inappropriate behavior (represented by the line graph) and percentage of times that he touched the "play" card rather than complied with the task demand (represented by the histogram) during the choice-making analysis. Middle panel: The cumulative number of times Kevin chose to pick up one rather than 10 or more of his toys during follow-up probes. Bottom panel: Kevin's percentage of inappropriate behavior during follow-up probes.

to engage in a mand response rather than an inappropriate response. In this study, an FR 1 schedule was in effect for both responses, but duration and quality of reinforcement varied across response options. Increasing both duration and quality served to bias the participants' response allocation in the desired direction.

These results also extend the work of Horner and Day (1991) by including children with chronic health problems who engaged in potentially life-threatening behaviors. This study evaluated choice-making behavior by varying parameters of reinforcement for appropriate and neutral responses. Horner and Day provided a direct analysis of the effects of different parameters of reinforcement by conducting reversals using aberrant responses and manding behavior. The current study demonstrates that it may be possible to conduct similar analyses of choice making more indirectly by substituting a relatively neutral response (i.e., touching a ball) for an aberrant response when the aberrant response is life threatening.

This study, along with that by Horner and Day (1991), provides evidence that choice-making packages that include FCT can be enhanced by increasing the duration and quality of reinforcement provided for a mand response while minimizing the duration and quality of reinforcement provided for an aberrant response. In this study, the choice-making packages combined both reinforcer duration and quality to produce a strong intervention effect, which we hoped would allow us to limit the use of extinction and punishment contingencies to reduce problem behavior. Often, a mild reductive procedure, such as extinction or punishment, is a necessary component of FCT packages if inappropriate behavior is to be reduced to acceptable levels (Fisher et al., 1993; Wacker et al., 1990). This study provides evidence that it may be possible to reduce the need for extinction and punish-

ment in FCT packages if the duration and quality of reinforcement for the mand response are maximized. This study, however, did not completely exclude the use of extinction. Extinction was used as a component of the intervention package, specifically for the more mild inappropriate responses. Thus, it is not possible to determine the overall effect of extinction on the results obtained in the present study. It is unlikely that extinction was responsible for reducing the primary problem behaviors, however, because these responses always received at least some reinforcement.

To date, applied studies of concurrent operants (e.g., Neef et al., 1992, 1993) have demonstrated the effects of concurrent schedules of positive reinforcement. In this study, the effects of concurrent schedules of negative reinforcement were also analyzed for 2 children (Maxwell and Kevin). For both children, the results of the choice-making analyses were similar to those of children whose inappropriate behavior was maintained by positive reinforcement. The finding that similar results occurred for both positive and negative reinforcement is noteworthy, because this is the first demonstration of these effects in the applied literature. Relatively little is known about negative reinforcement (Iwata, 1987), and it has been only recently that negative reinforcement has been used in treatment programs for aberrant behavior (Steege et al., 1990). Of the few studies conducted, most have permitted the participant to avoid task demands via manding for breaks or assistance (Carr & Durand, 1985; Wacker et al., 1990). Fewer studies have required compliance, most typically via escape extinction (Goh & Iwata, 1994; Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990; Mace & Belfiore, 1990; Zarcone et al., 1993). For both Maxwell and Kevin, choice-making behavior varied as a function of the duration and quality of reinforcement (length of breaks and availabil-

ity of toys and attention on breaks) provided for either manding or task compliance. In each condition of the choice-making analysis, the participants learned to choose the stimulus that resulted in the longest break. Of equal importance was that when the participants selected the stimulus associated with the task, they were required to briefly comply with the task (e.g., put one toy away) prior to being provided with reinforcement. Thus, when the participants touched the task more often than they manded, they chose to comply with the task to receive a longer duration and higher quality of reinforcement rather than to avoid the task and receive a shorter duration and lower quality of reinforcement. These results suggest that compliance to task demands can be increased without a correlated increase in inappropriate behavior if the duration and quality of reinforcement provided for compliance are greater than the duration and quality of reinforcement provided for manding. It should be noted, however, that the interventions used in this study combined the use of both positive and negative reinforcement. It is unclear whether similar results would have been obtained if the positive reinforcement component (e.g., toys and attention) had been removed.

The goal of intervention for children who engage in aberrant behavior is to motivate them to engage in an appropriate response alternative (Mace & Roberts, 1993). In this study, the goal of the choice-making intervention was to bias response allocation in the desired direction when two concurrent responses, maintained by the same reinforcer, were always available. Specific applications of this treatment varied substantially given the environmental context. For example, for Alexander, whose life-threatening line pulling appeared to be maintained by attention, treatment consisted of providing greater attention for a mand than for inappropriate behavior. Maxwell's self-injury, on the other hand, was not life threatening. However, it occurred with such intensity when his teachers prompted him to participate in tasks that he was rarely required to complete any classroom activities. The treatment package for Maxwell consisted of first gaining compliance to task demands via FCT and then providing him with longer breaks if he chose to interact with his peers. Although all of the treatment packages provided increased reinforcement for an appropriate response, each specific treatment package was individualized to match the environmental context of the problem behavior. In all cases, these treatment packages resulted in an increase in appropriate responding and a concurrent decrease in inappropriate responding.

On a cautionary note, we did not separate duration from quality of reinforcement. Previous studies with humans (Neef et al., 1992, 1993) have shown that quality may be a potent dimension of reinforcement. Subsequent investigators should consider separating quality from duration to determine the differential effects associated with each dimension of reinforcement.

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STUDY QUESTIONS

1. The authors cited research indicating that at least four variables may influence response choice between adaptive and aberrant behavior. What are these variables, which one was examined in the present study, and how was that variable typically operationalized?

2. The referring behavior problems were of particular relevance to this study. Give some examples of these behaviors and indicate how they influenced (a) the type of initial assessment that was conducted, (b) the selection of target behaviors, and (c) the types of consequences that were evaluated.

3. What were the major components of and differences between the two assessment methods used in the study?

4. False lines were substituted for real lines in the choice-making analysis for Alexander. Describe some other topographies of aberrant behavior (not examined in this study) that, due to their severity, might also be assessed and treated more safely using this type of strategy.

5. Describe the concurrent operants arrangement in general and the two ways in which it was incorporated into the present study.

6. How did the authors demonstrate experimental control over response distribution during the choice-making analysis?

7. In much of the current research, choice making is considered to be an independent variable that may have beneficial effects on other behavior (i.e., the availability of choices increases adaptive behavior or reduces aberrant behavior). What was the role of choice making in the present study?

8. A number of outcomes associated with assessment and treatment were presented in this study, but what is the most general implication of the results for the treatment of behavior disorders?

Questions prepared by Iser DeLeon and Julie Burke